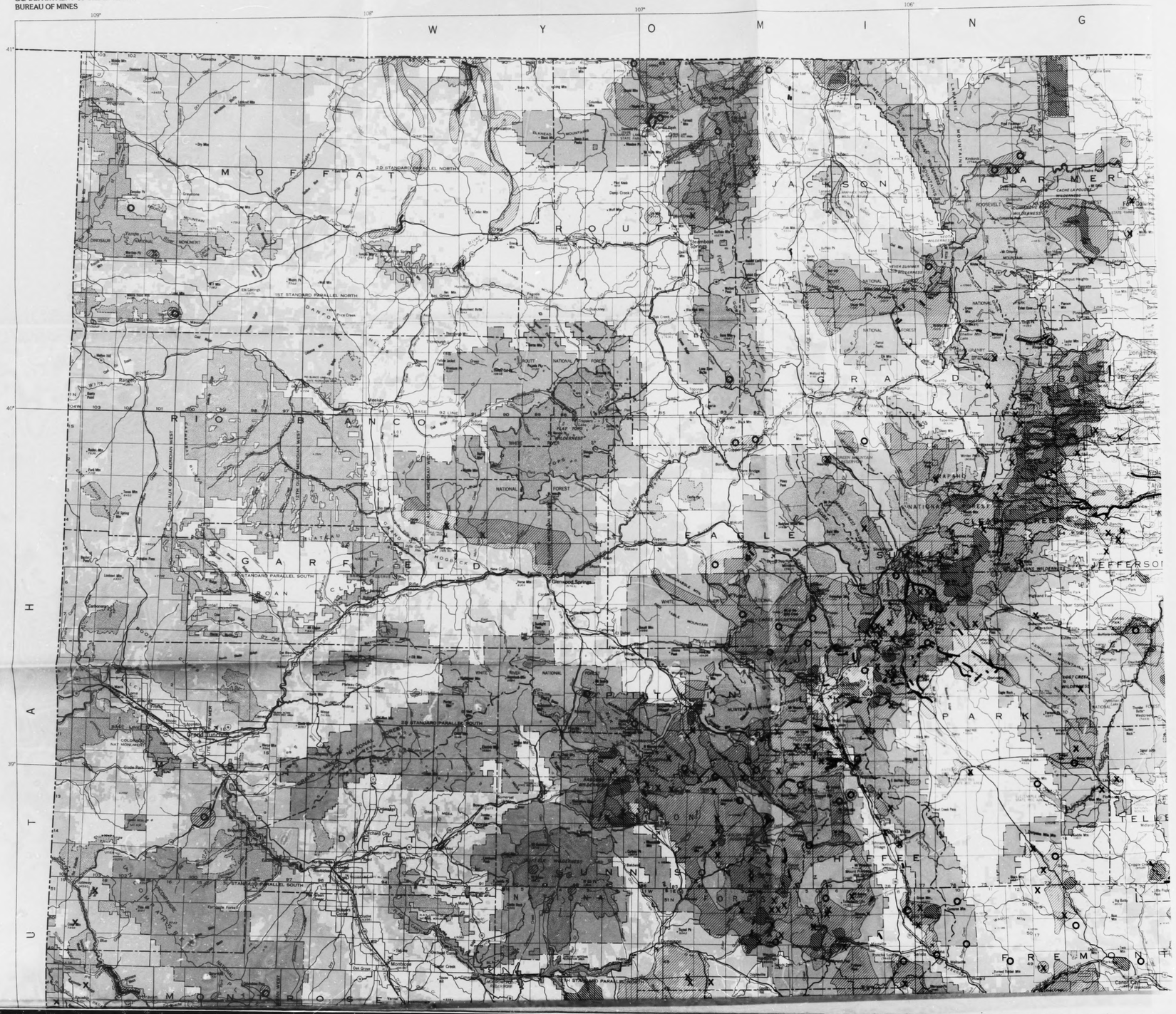
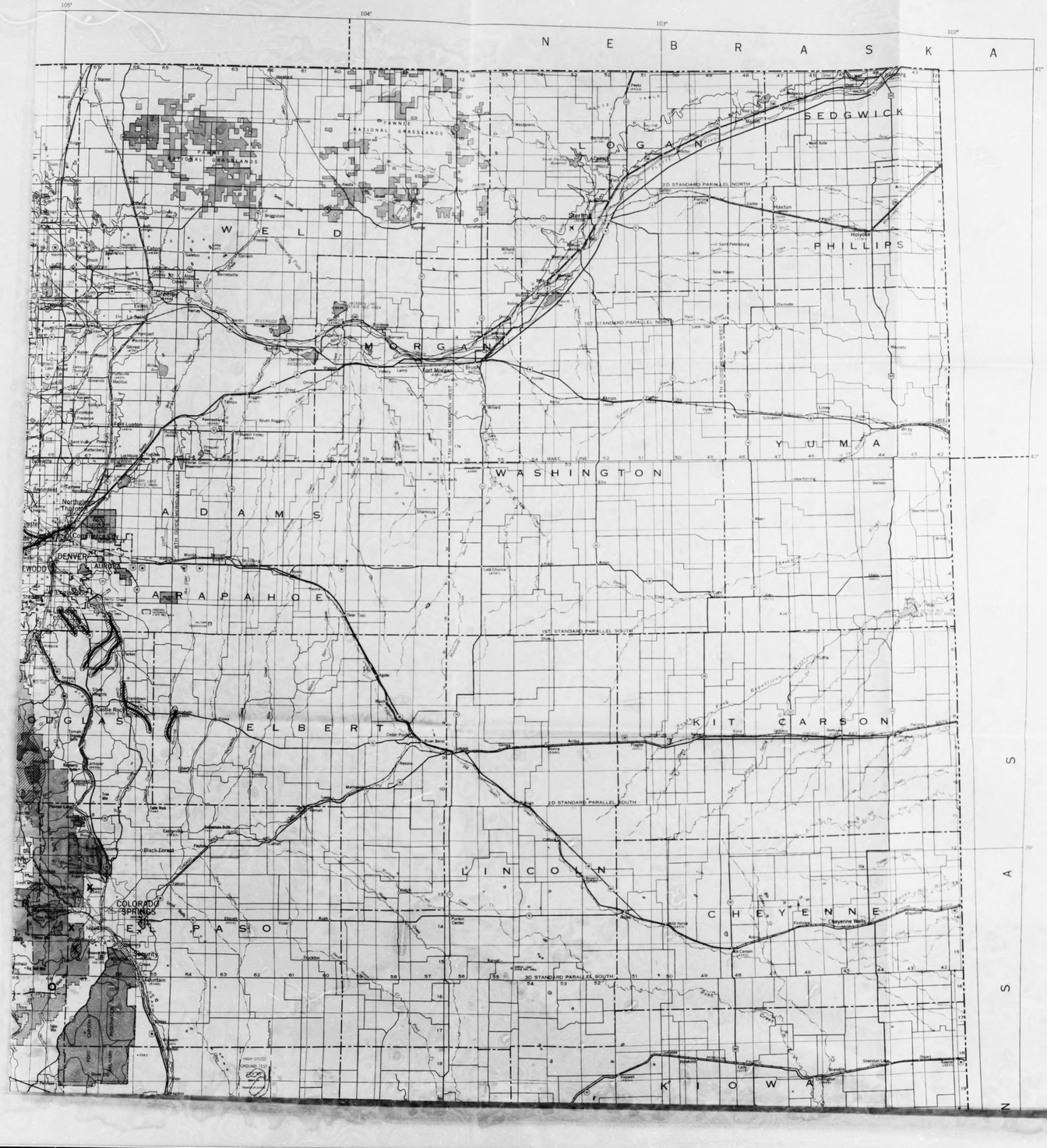
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF MINES





EXPLANATION

FEDERAL LAND (SURFACE) OWNERSHIP

NATIONAL FOREST OR GRASSLAND—Administered by Forest Service

PUBLIC LAND—Administered by Bureau of Land Management

OTHER FEDERAL LAND—Includes land under jurisdiction of Departments of Agriculture, Defense, Energy, and Interior (Bureau of Reclamation, Fish and Wildlife Service, National Park Service), General Services Administration, and Veterans Administration

AVAILABILITY OF FEDERAL LAND

Federal lands not labeled are available for mineral exploration and development for the commodities indicated, subject to (1) moderate or slight restrictions, such as seasonal restrictions on surface occupancy, or (2) standard stipulations for leasing and normal regulations for protection of surface resources. Determination of these categories of availability status is described more fully in the report text.

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AREA UNAVAILABLE OR SEVERELY RESTRICTED (LEGAL)—Includes areas unavailable or severely restricted to mineral exploration and development to such an extent that these activities are greatly discouraged by formal congressional or executive methods, including laws, executive and secretarial orders, and public land orders

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MINERAL FAVORABILITY

This map shows areas in Colorado that are favorable for locatable minerals that have relatively high unit value. It includes most metals (except aluminum, uranium, and vanadium, which are shown on other maps), and certain industrial minerals, but construction and common industrial minerals are excluded. The selected metals include gold, silver, lead, zinc, copper, iron, molybdenum, tungsten, tin, manganese, titanium, beryllium, rare earths, columbium (niobium), tantalum and thorium; the industrial minerals include fluorspar, barite, gem stones, sulfur, diamonds, and the pegmatite minerals feldspar, mica, and quartz.

No compilation of resource distribution or of areas of resource favorability for the selected minerals is available that is comparable with the compilations used as principal sources for the other maps in this study. Compilations made for other purposes, not wholly consonant with the objectives of this analysis, have been used to make this map because more exacting evaluations of mineral favorability for most areas are not available.

KNOWN DEPOSITS AND PRODUCTIVE AREAS—Includes areas with known deposits, significant productions, productive mining districts, and/or identified resources. Compiled by Bureau of Mines from many sources, principally from Vanderwilt and others (52), Hanley and others (15), Lovering and Goddard (19), U.S. Geological Survey (48), Parker (27), Mardirosian (20), and Hornbaker and Collins (17), and the Bureau of Mines Mineral Industry Location System (MILS).

Mining district, cluster of deposits, or identified resources

O Mining district—Exact location of individual mines or deposits unknown

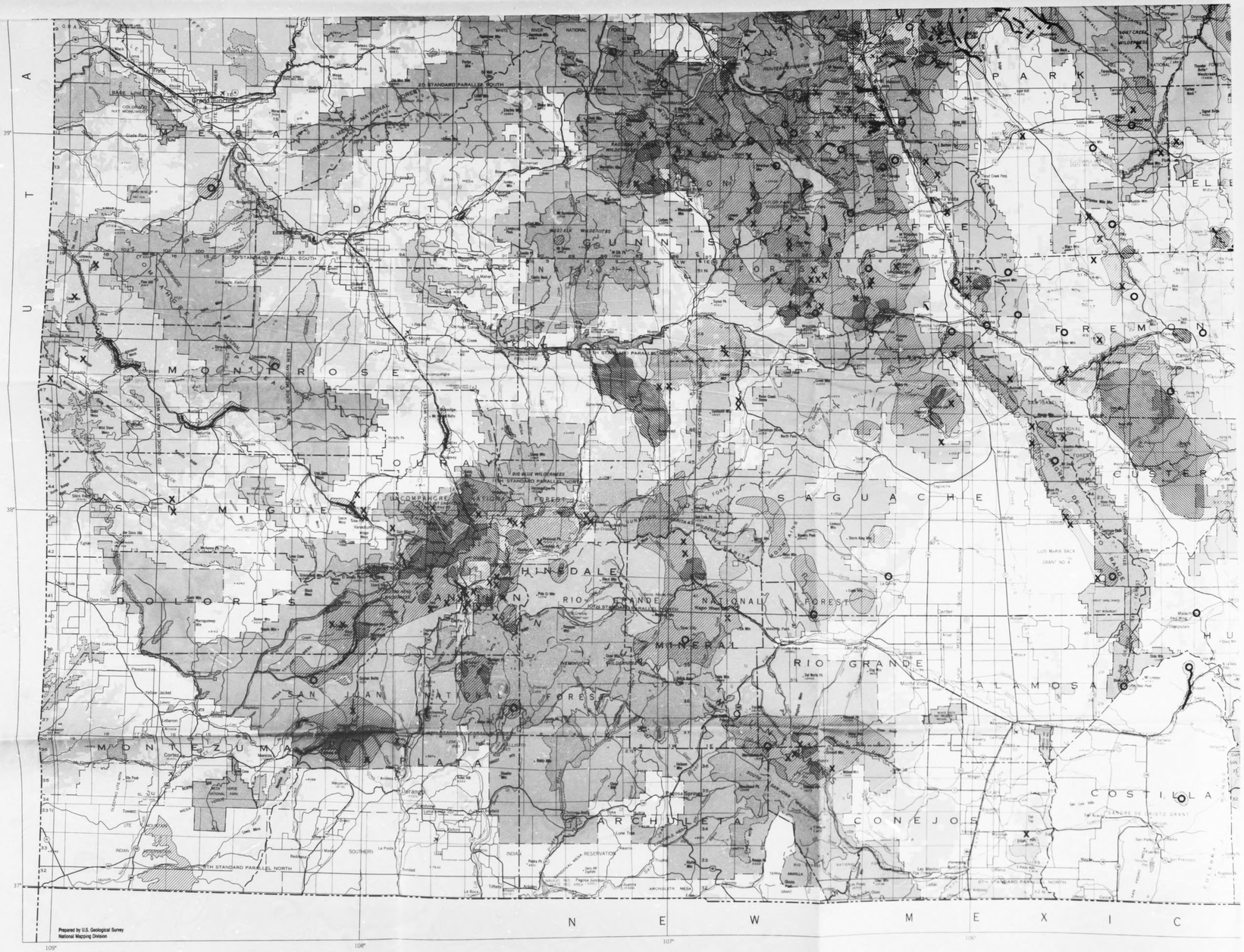
X Productive or potentially productive deposit—Outside mining district

Productive placer deposit—Outside mining district

FAVORABLE—Includes areas with mineral favorability and areas with certain known submarginal resources. Compiled by Bureau of Mines principally from a preliminary map by Tweto and Steven (37), and an unpublished compilation by Dersch (10), supplemented by data from Tweto (36), U.S. Geological Survey (49), Hornbaker and Collins (17), and Minerals Exploration Coalition (28). Includes areas of mineral-resource potential in certain wilderness study areas designated by the Bureau of Mines and U.S. Geological Survey (21). Areas designated based on geologic environment, mineral occurrences, proximity to productive areas or deposits, and/or mineral industry activity.

LESS FAVORABLE OR UNKNOWN—Includes remaining areas. The term "less favorable or unknown" is applied to areas where favorability, for selected minerals, as defined above, has not been demonstrated; this designation does not imply the absence of minerals, only the lack of evidence of favorability as defined here. Owing to the variety of minerals included, the even wider variety of possible types of deposits in which these minerals might be found, and the lack of evaluation of mineral favorability for much of the State, these areas are classed as less favorable or unknown, rather than as unfavorable.

[1] Underlined numbers in parentheses refer to items in the list of references in the accompanying report.

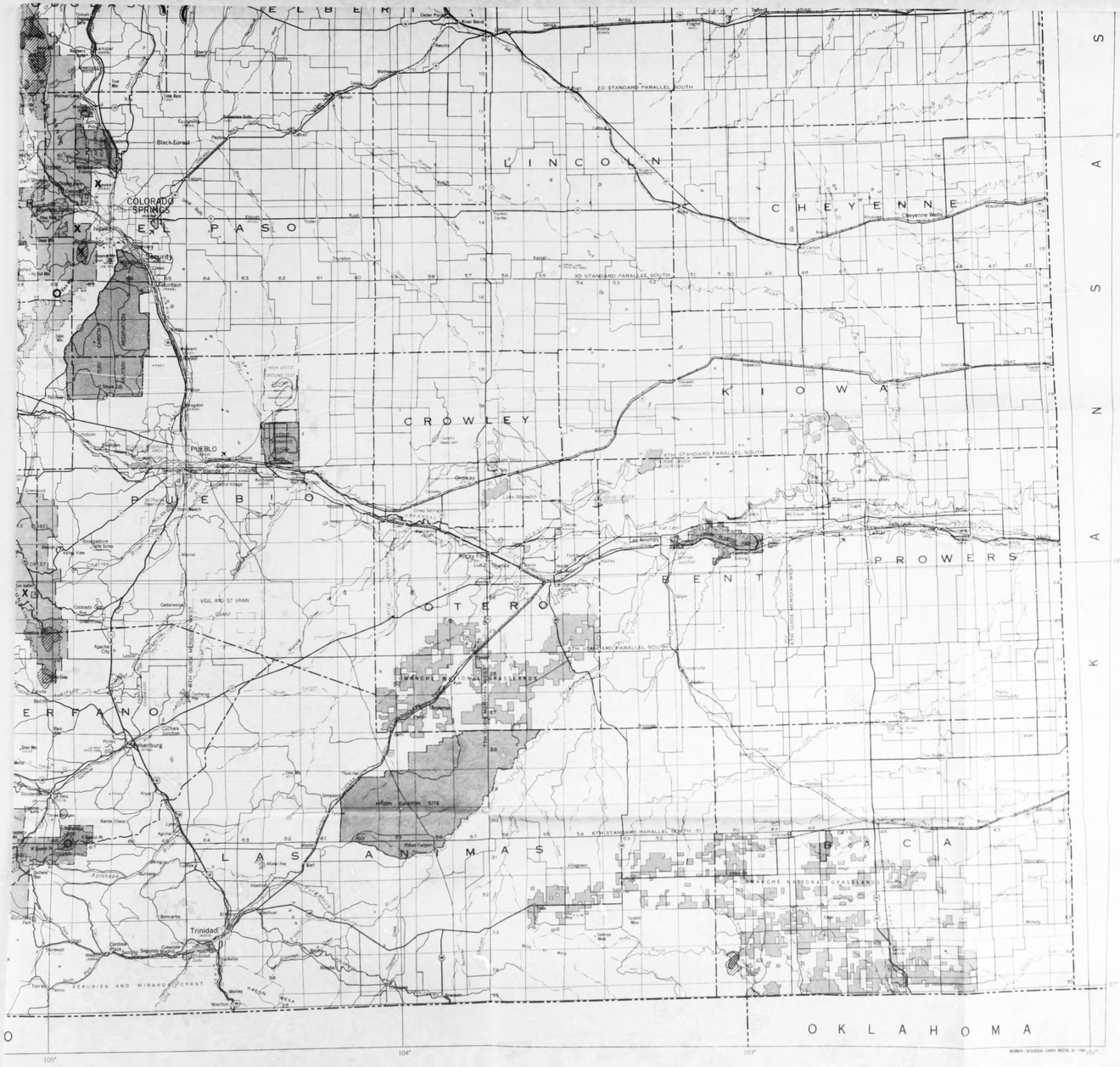


Prepared by U.S. Geological Survey
National Mapping Division

Base modified from U.S. Geological Survey, 1968, revised 1980
Lambert conformal conic projection based
on standard parallels 33° and 45°

AVAILABILITY OF FEDERAL LAND COMPARED TO AREAS FAVORABLE FOR SELECTED

1984



tive mining districts, and/or identified resources. Compiled by Bureau of Mines from many sources, principally from Vanderwilt and others (52), Manley and others (15), Lovering and Goddard (19), U.S. Geological Survey (48), Parker (27), Mandrosian (20), and Hornbaker and Collins (17), and the Bureau of Mines Mineral Industry Location System (MILS)

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NOTES TO MAP USERS

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SCALE 1:500,000

1 inch equals approximately 8 miles (13 kilometers)
(slightly more approximately 1 kilometer [1 mile])

10 0 10 20 MILES
10 0 10 20 30 KILOMETERS

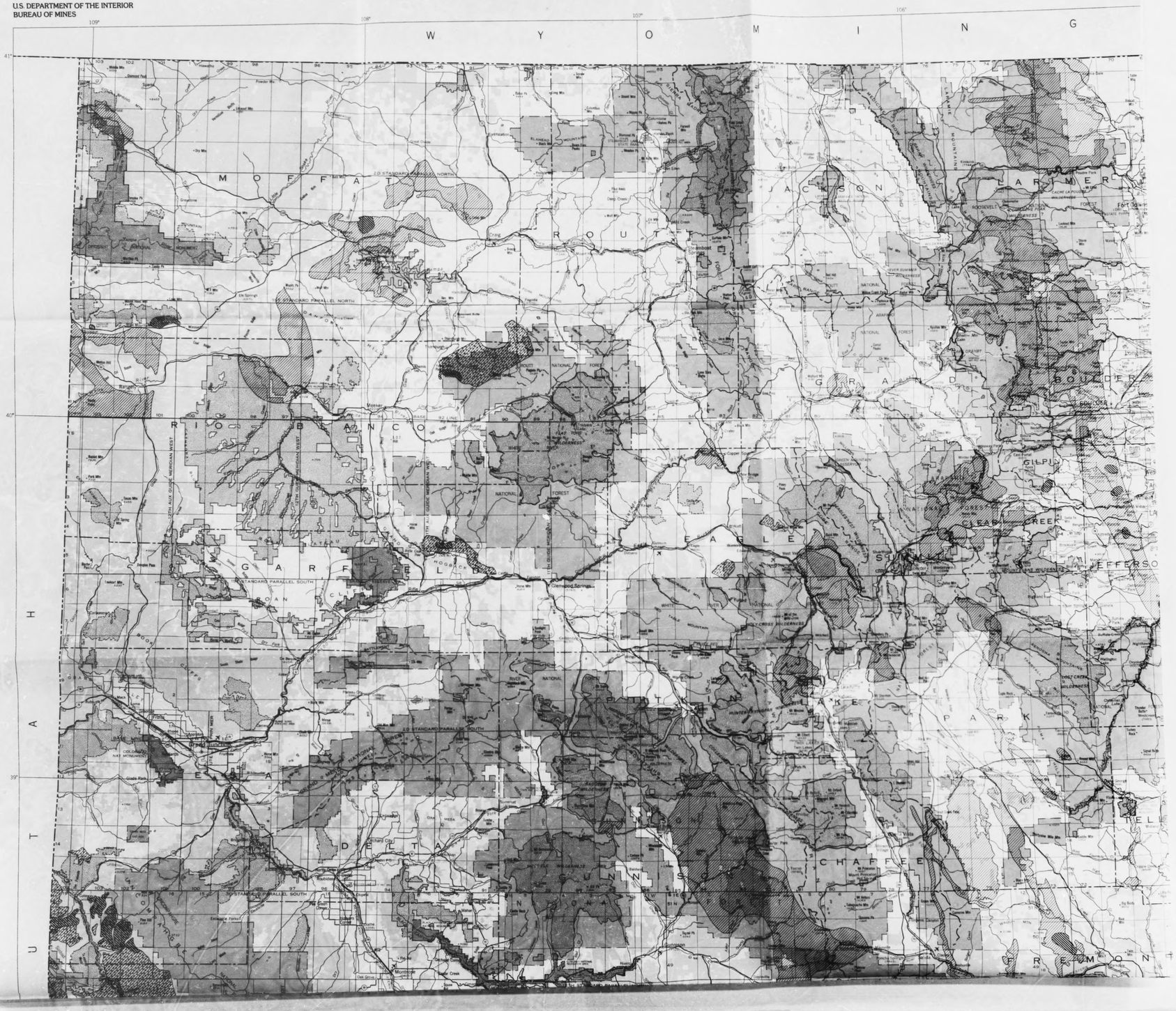
NATIONAL GEODETIC VERTICAL DATUM OF 1929

N

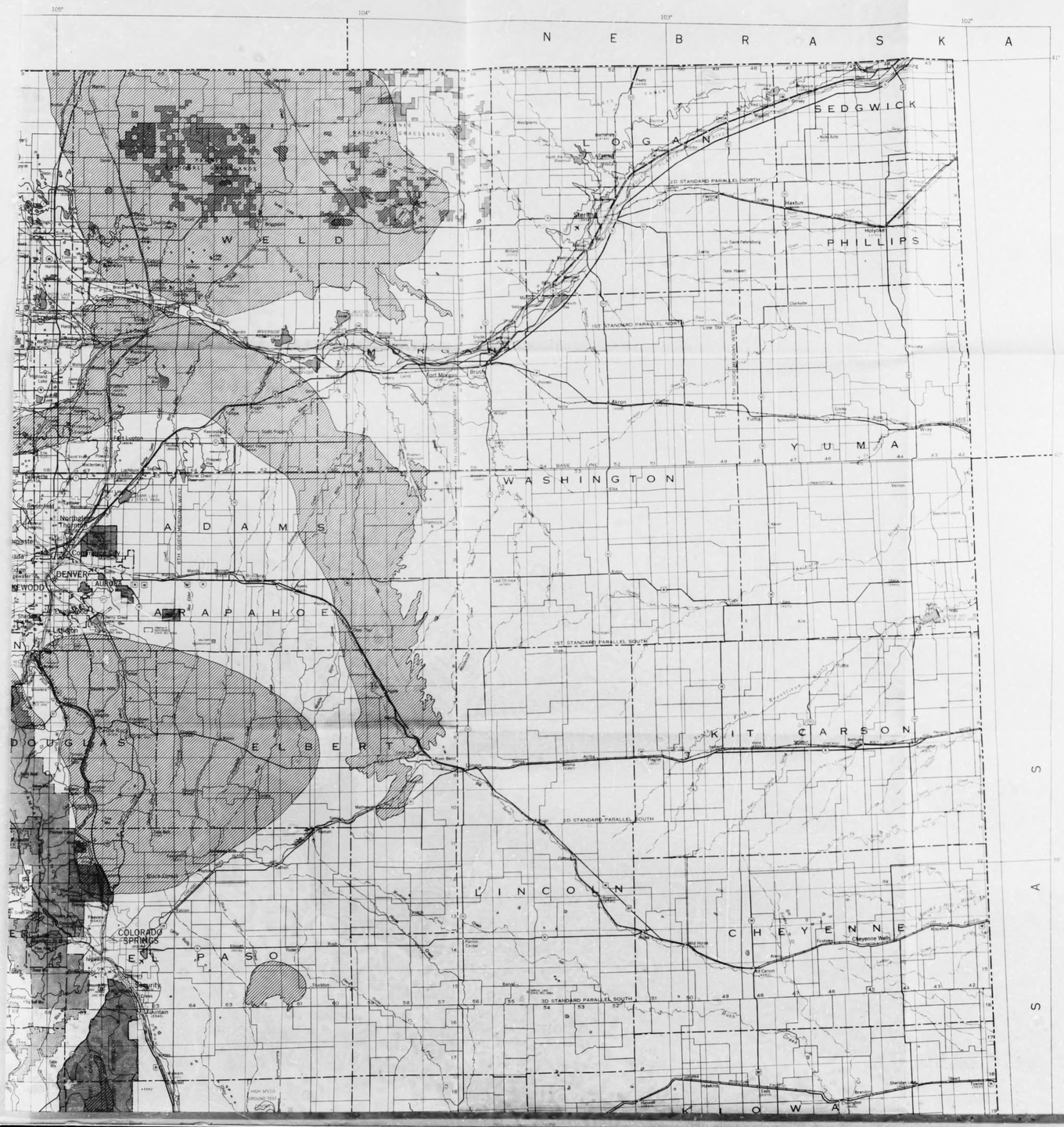
U.S. DEPARTMENT OF THE INTERIOR
U.S. BUREAU OF MINES

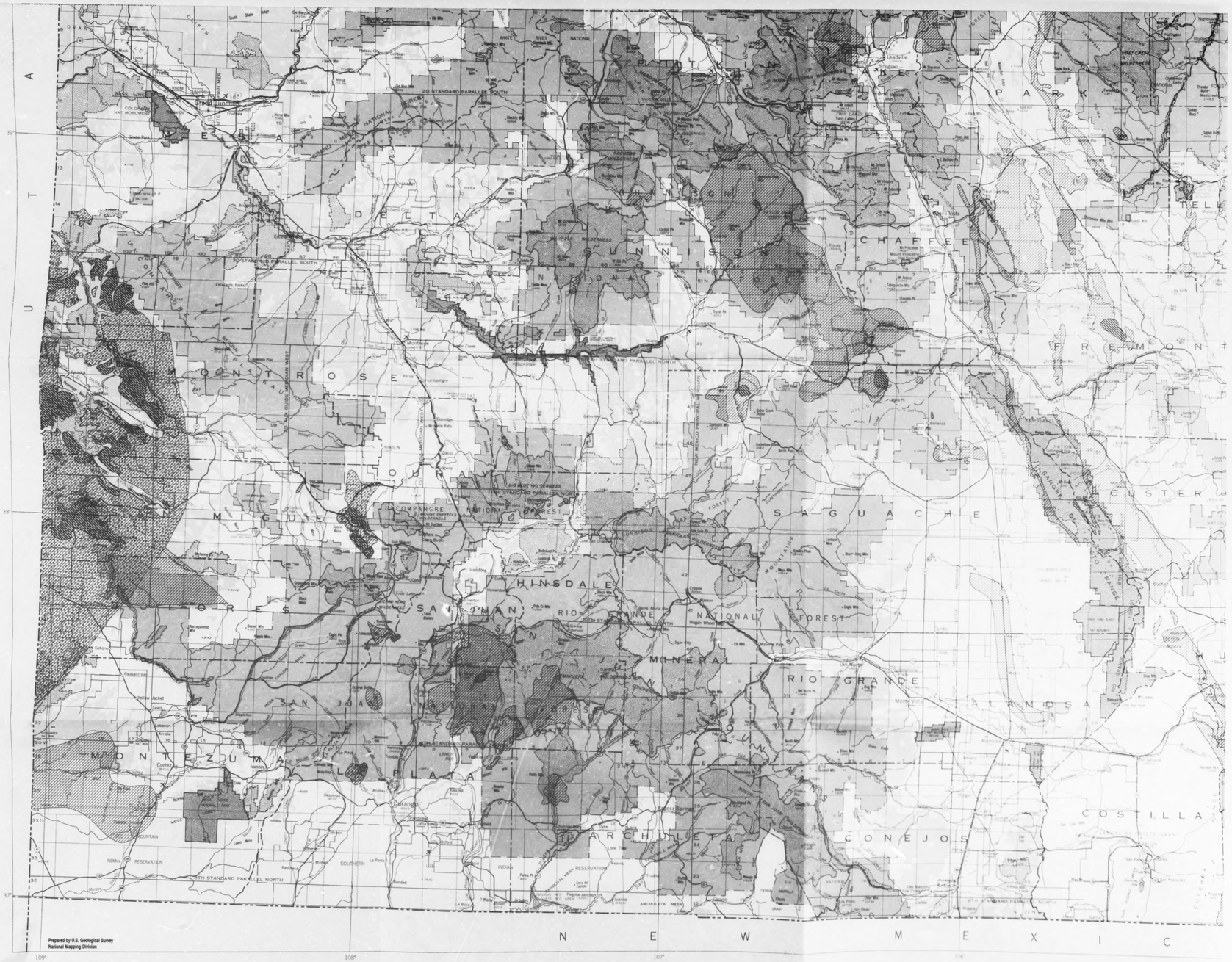
METALLIC AND NONMETALLIC MINERALS IN COLORADO

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF MINES



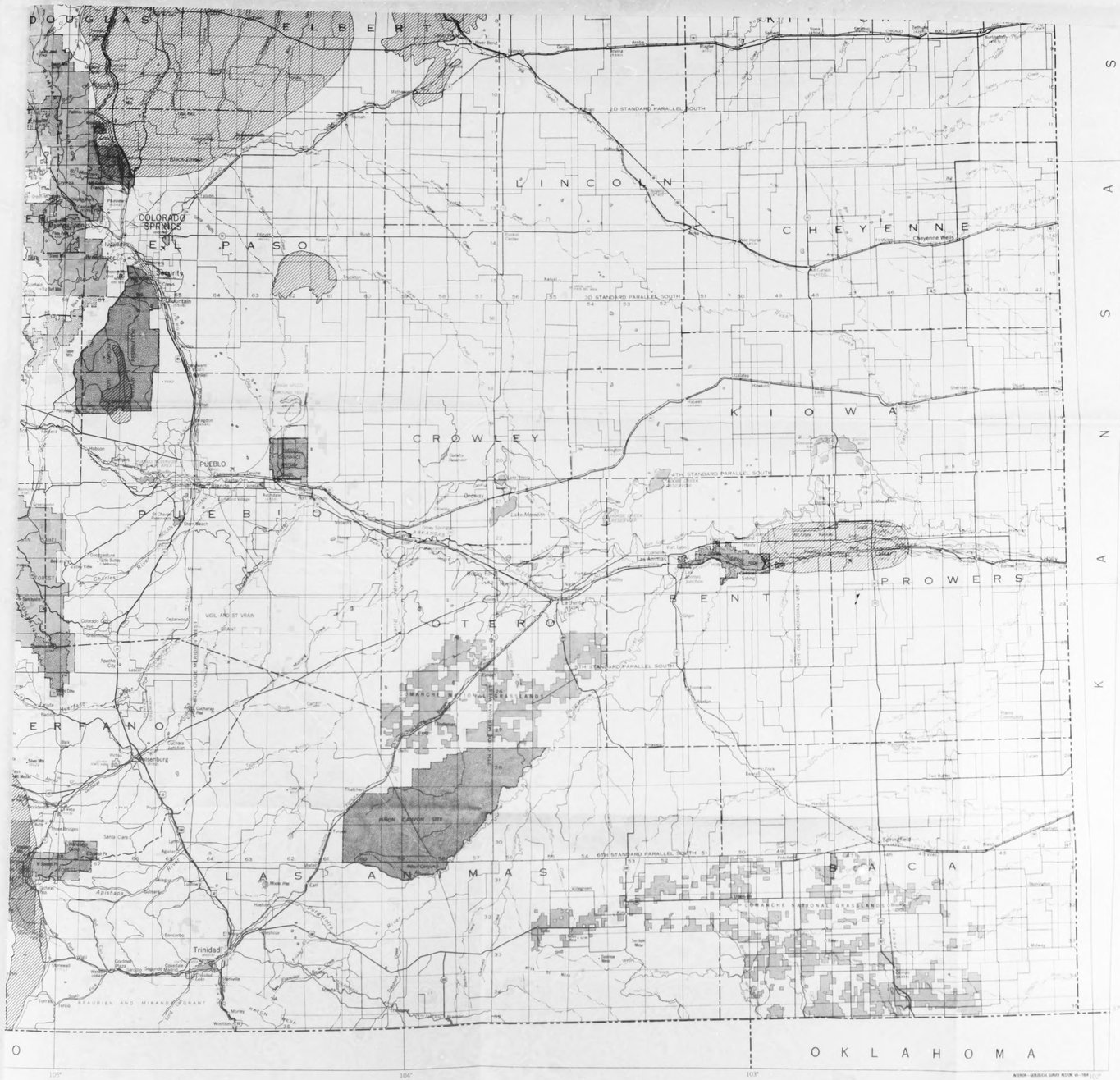
SPECIAL PUBLICATION
PLATE 2


105°
104°
103°
102°
41°
N E B R A S K A
SEDGWICK
LOGAN
PHILLIPS
WELD
YUMA
WASHINGTON
ADAMS
ARAPAHOE
DOUGLAS
ELBERT
KIT CARSON
LINCOLN
CHEYENNE
EL PASO
KIOWA
20 STANDARD PARALLEL NORTH
10 STANDARD PARALLEL NORTH
1 STANDARD PARALLEL SOUTH
10 STANDARD PARALLEL SOUTH
30 STANDARD PARALLEL SOUTH
6TH PRINCIPAL MERIDIAN
24 BASE LINE
Sterling
Haxtun
Holyoke
Fort Morgan
Brush
Akron
Fort Lupton
Greeley
Longmont
Northglenn
Thornton
Commerce City
DENVER
AURORA
Littleton
Englewood
Parker
Castle Rock
Franktown
Black Forest
Falcon
COLORADO SPRINGS
Security
Fountain
Yoder
Kit Carson
Cheyenne Wells
Arapahoe
Wray
Yuma
Idalia
Joes
Julesburg
Sedgwick
Ovid
Crook
Peetz
Paoli
Merino
Atwood
Holyoke
Haxtun
Saint Peterburg
New Haven
Log Lane Village
Iliff
Proctor
Orchard
Otis
Eckley
Wiggins
Roggen
Keenesburg
Hudson
Lochbuie
Erie
Platteville
Gilcrest
Kersey
Ault
Pierce
Nunn
Windsor
Severance
Johnstown
Milliken
Berthoud
Loveland
Fort Collins
Timnath
Wellington
Bellvue
Laporte
Masonville
Estes Park
Lyons
Boulder
Longmont
Lafayette
Louisville
Superior
Broomfield
Westminster
Arvada
Wheat Ridge
Golden
Lakewood
Aurora
Littleton
Englewood
Sheridan
Sheridan Lake
Branson
Holly
Granada
Lamar
Las Animas
Hasty
Bristol
Wiley
Granada
Boone
Rocky Ford
Manzanola
Fowler
Swink
La Junta



AVAILABILITY OF FEDERAL LAND COMPARED TO AREAS FAVORABLE FO

1984



Hornbaker and Collins (17)

FAVORABLE—Includes areas designated by National Uranium Resource Evaluation (NURE) reports (51). The term "favorable" is applied only to areas that can be demonstrated, using Department of Energy (DOE) recognition criteria (22), to have favorable geologic characteristics or to have significant uranium mineralization. Favorable areas have the potential to contain a minimum of 100 tons U_3O_8 at a grade of at least 0.01 pct. U_3O_8. Also includes favorable areas in the Grand Junction, Limon, and Sterling quadrangles designated by Hornbaker and Collins (17), and areas in Rocky Mountain National Park designated by the Bureau of Mines

UNFAVORABLE OR UNEVALUATED—Includes areas designated by NURE reports (51), and sources listed above. The term "unfavorable" is applied to areas where favorability, as defined above, has not been demonstrated. The term "unevaluated" is restricted to areas that were inaccessible or where data were insufficient to permit a rating of favorable or unfavorable. An unfavorable or unevaluated designation does not imply the absence of uranium deposits, only the lack of strong positive evidence of favorability as defined above

Vanadium

KNOWN DEPOSITS AND PRODUCTIVE OR FAVORABLE AREAS—Includes areas of byproduct or coproduct vanadium deposits and areas favorable for vanadium that can be produced together with uranium. Modified from Charnoweth (5) and Fischer (13).

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1 centimeter equals approximately 5 kilometers (3 miles)

10 0 10 20 MILES
10 0 10 20 30 KILOMETERS

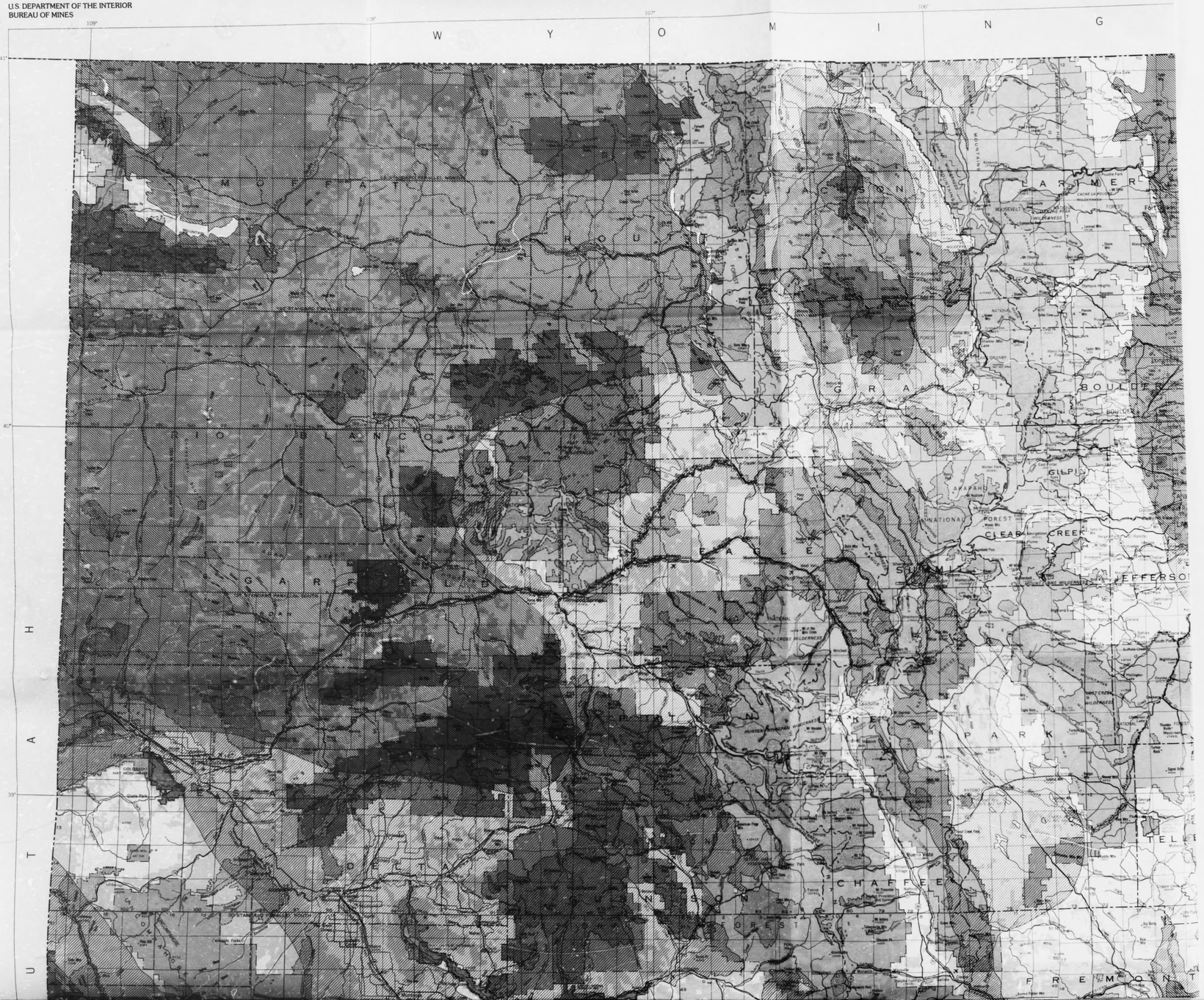
NATIONAL GEODETIC VERTICAL DATUM OF 1929

N

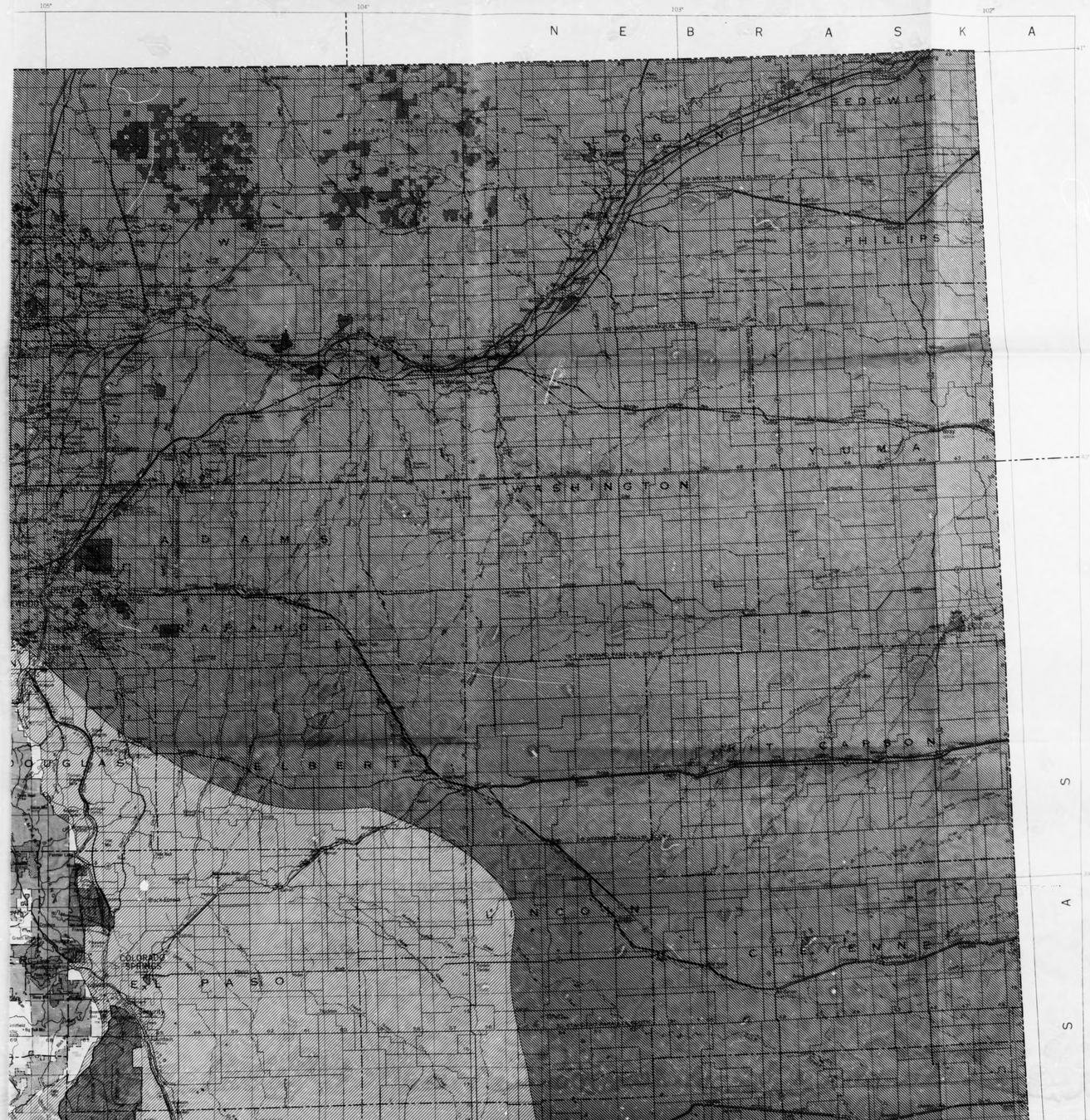
U.S. DEPARTMENT OF THE INTERIOR
U.S. BUREAU OF MINES

R URANIUM AND VANADIUM IN COLORADO

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF MINES



SPECIAL PUBLICATION
PLATE 3



EXPLANATION

FEDERAL LAND (SURFACE) OWNERSHIP

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PUBLIC LAND—Administered by Bureau of Land Management

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MINERAL FAVORABILITY

OIL AND/OR GAS FIELDS AND ADJACENT AREAS OF SEDIMENTARY ROCKS—Adapted from Scanlon (31, 32).

PERMISSIBLE AREAS WHERE SEDIMENTARY ROCKS ARE KNOWN OR BELIEVED TO EXIST—Includes areas where volcanic rocks cover sedimentary rocks or where unfavorable older rocks are thrust over sedimentary rocks (34, 36). Includes small areas underlain by unfavorable intrusive rocks.

AREAS UNFAVORABLE FOR OIL OR GAS—Includes areas where intrusive or basement (Precambrian) rocks are exposed or are covered by only a thin sequence of sedimentary rocks (29, 34, 36).

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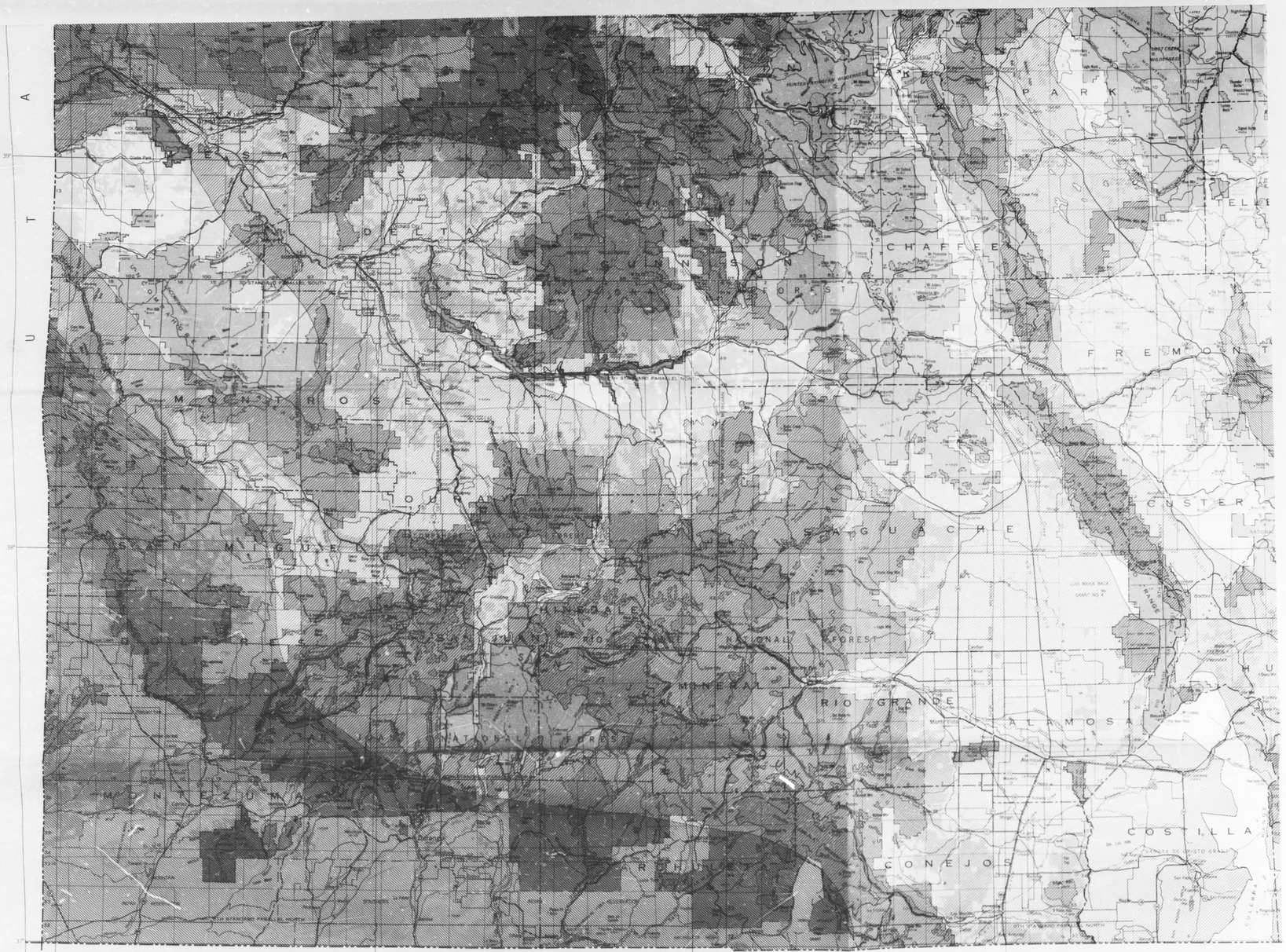
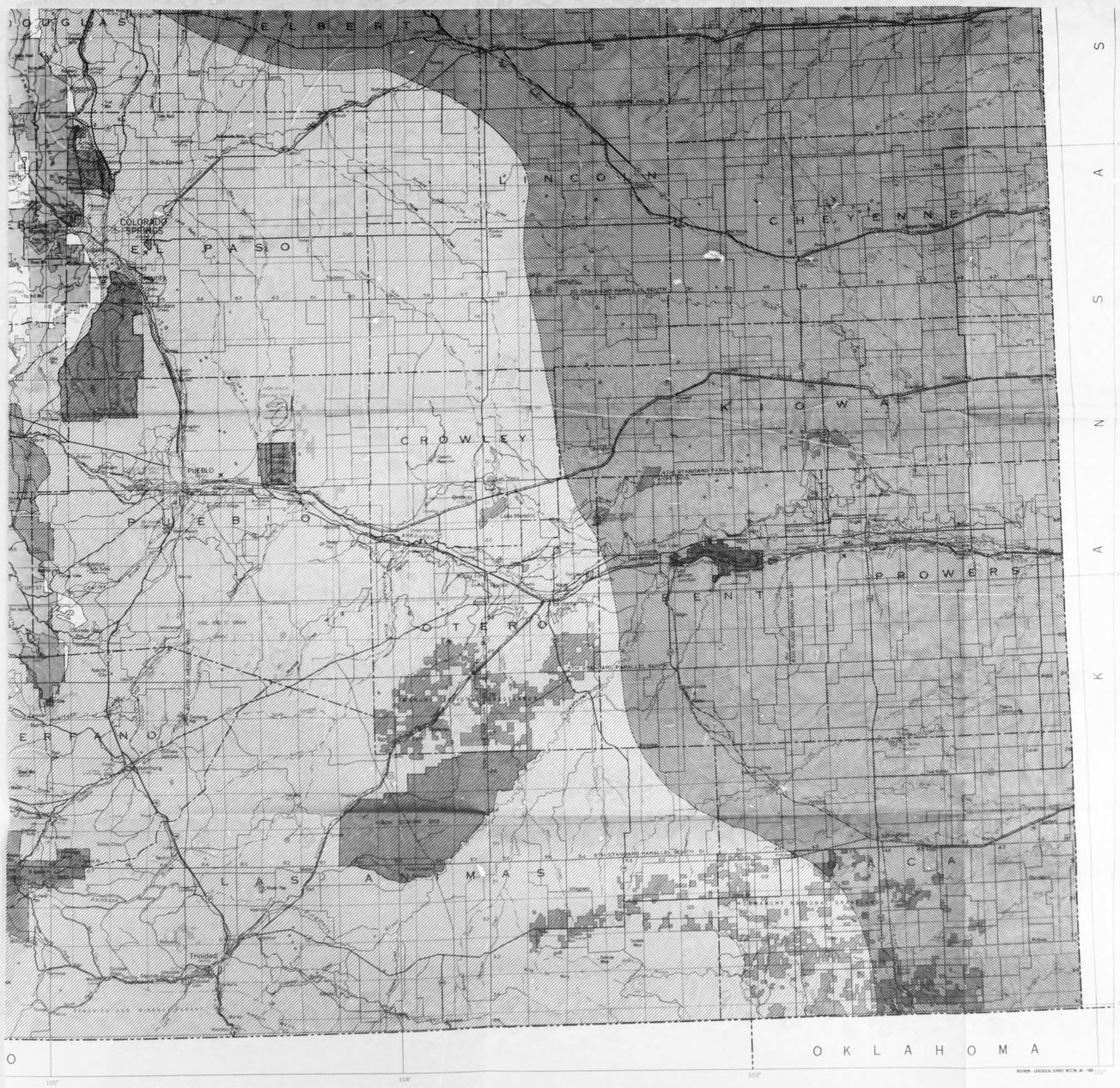


Prepared by U.S. Geological Survey
National Mapping Division

Base modified from U.S. Geological Survey, 1968, revised 1980
Lambert conformal conic projection based
on standard parallels 33° and 45°

AVAILABILITY OF FEDERAL LAND COMPARED TO AREAS FAVORABLE FOR P

1984



MINERAL FAVORABILITY

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10 0 10 20 30 KILOMETERS

NATIONAL GEODETIC VERTICAL DATUM OF 1929

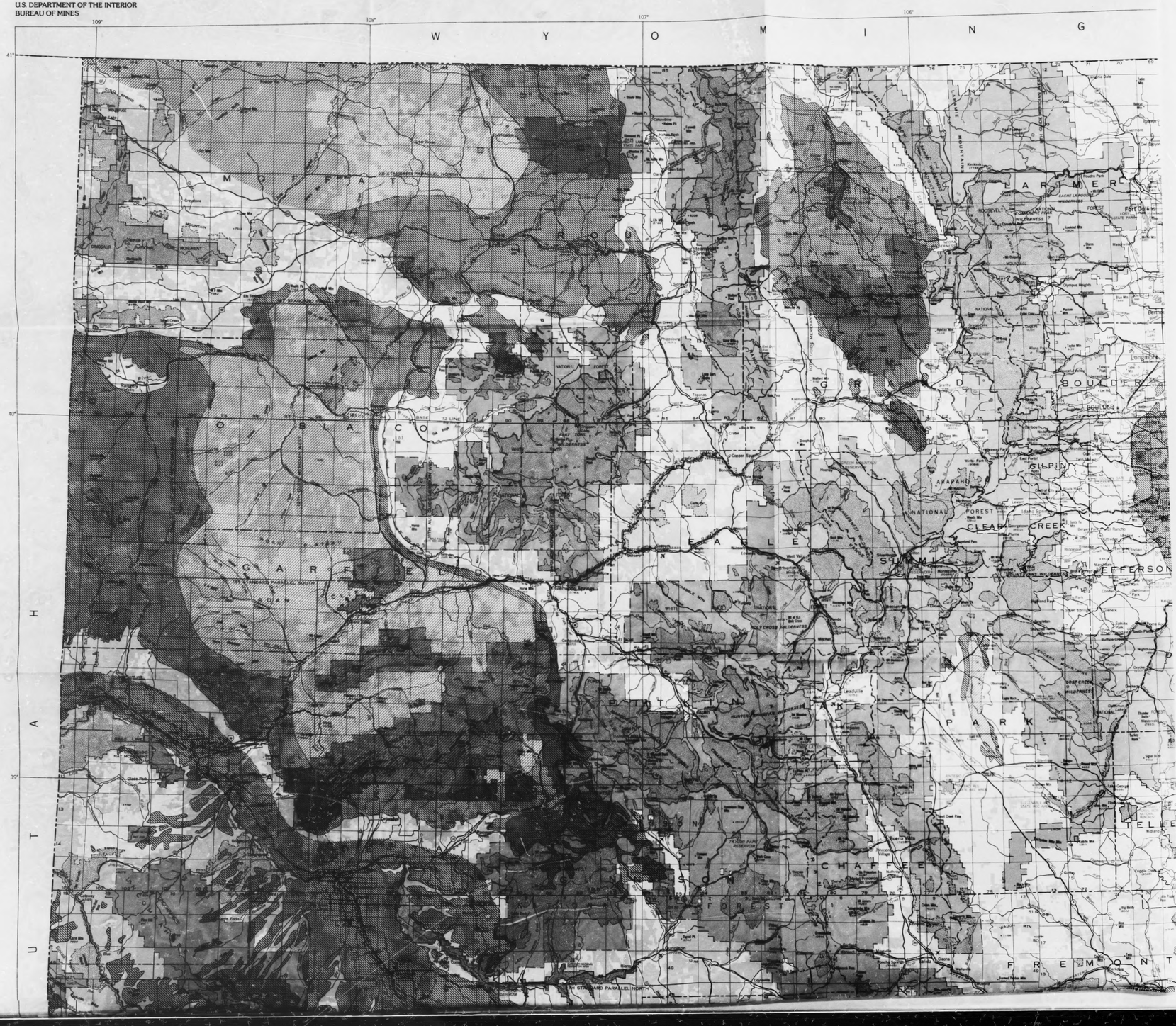
N

DEPARTMENT OF THE INTERIOR
U.S. BUREAU OF MINES

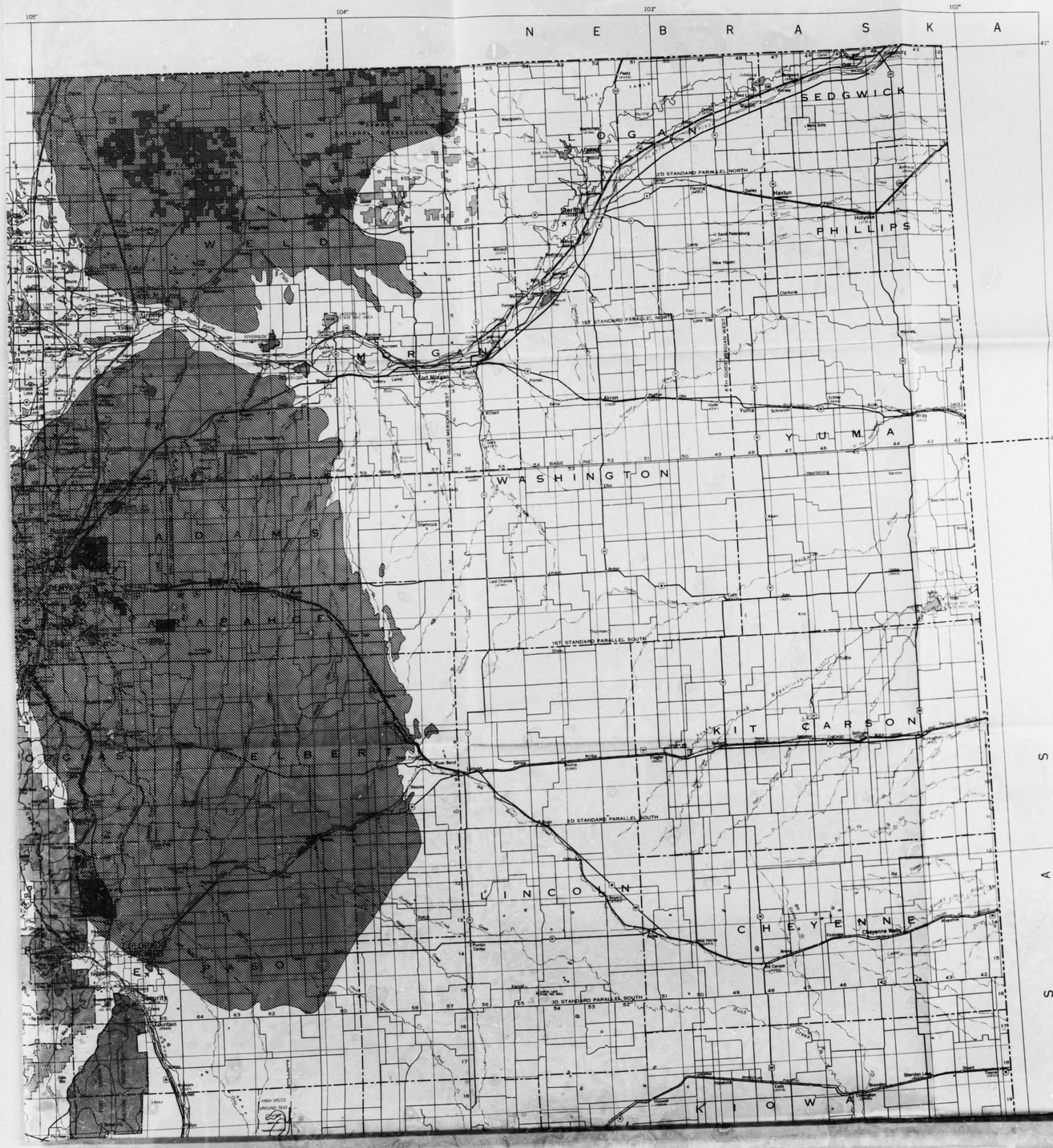
INTERIOR—GEOLOGICAL SURVEY, RESTON, VA.—1981

ETROLEUM AND NATURAL GAS IN COLORADO

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF MINES



SPECIAL PUBLICATION
PLATE 4


NEBRASKA
SEDGWICK
LOGAN
PHILLIPS
YUMA
WASHINGTON
MORGAN
ADAMS
ARAPAHOE
WELD
ELBERT
KIT CARSON
LINCOLN
CHEYENNE
KIOWA
EL PASO
40th STANDARD PARALLEL NORTH
39th STANDARD PARALLEL NORTH
38th STANDARD PARALLEL SOUTH
37th STANDARD PARALLEL SOUTH
105°
104°
103°
102°
41°
40°
39°
38°
37°
Sterling
Haxtun
Holyoke
Fort Morgan
Akron
Wray
Yuma
Brush
Fort Morgan
Limon
Burlington
Kit Carson
Cheyenne Wells
Eads
Sheridan Lake
Colorado Springs
Security
Widefield
Fountain
Calhan
Peetz
Merino
Atwood
Julesburg
Last Chance
Otis
Eckley
Hale
Idalia
Joes
Arriba
Genoa
Bovina
Seibert
Stratton
Hugo
Karval
Vona
Matheson
Simla
Ramah
Elbert
Kiowa
Deer Trail
Strasburg
Bennett
Watkins
Aurora
Peyton
Falcon
Black Forest
Ellicott
Yoder
Rush
Boone
Olney Springs
Sheridan Lake
Brandon
Towner
Hanover
Vernon
Hartshorne
Chivington
Wiley
Granada
Lamar
Las Animas
Model
Higbee
Hasty
Crowley
Ordway
Sugar City
Swink
Rocky Ford
Manzanola
Fowler
Caddoa
Boone
Hoehne
Aguilar
Walsenburg
Gardner
La Veta
Cuchara
Pueblo
Boone
Rye
Colorado City
Beulah
Blende
Wetmore
Westcliffe
Silver Cliff
Rosita
Coaldale
Howard
Salida
Poncha Springs
Maysville
Monarch
Garfield
Nathrop
Buena Vista
Johnson Village
Granite
Leadville
Malta
Twin Lakes
Clear Creek
Lake County
Chaffee County
Fremont County
Custer County
Huerfano County
Las Animas County
Baca County
Prowers County
Bent County
Crowley County
Otero County
Pueblo County
Kiowa County
Cheyenne County
Lincoln County
Elbert County
El Paso County
Teller County
Park County
Chaffee County
Fremont County
Custer County
Huerfano County
Las Animas County
Baca County
Prowers County
Bent County
Crowley County
Otero County
Pueblo County
Kiowa County
Cheyenne County
Lincoln County
Elbert County
El Paso County
Teller County
Park County
Arapahoe County
Adams County
Weld County
Morgan County
Washington County
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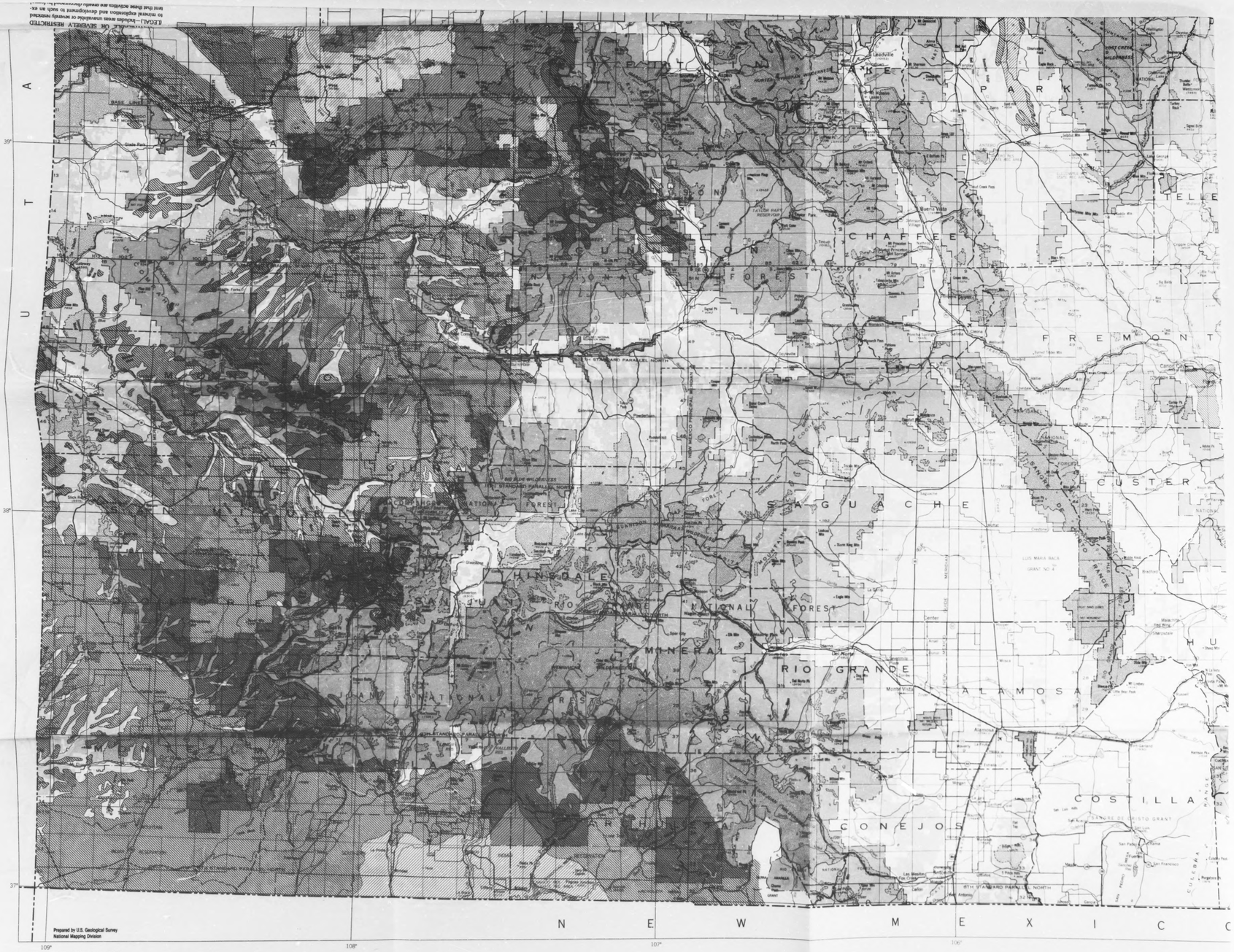
New Mexico
Utah
Arizona
Colorado
Missouri
Oklahoma
Texas



Prepared by U.S. Geological Survey
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Base modified from U.S. Geological Survey, 1968; revised 1980
Lambert conformal conic projection based
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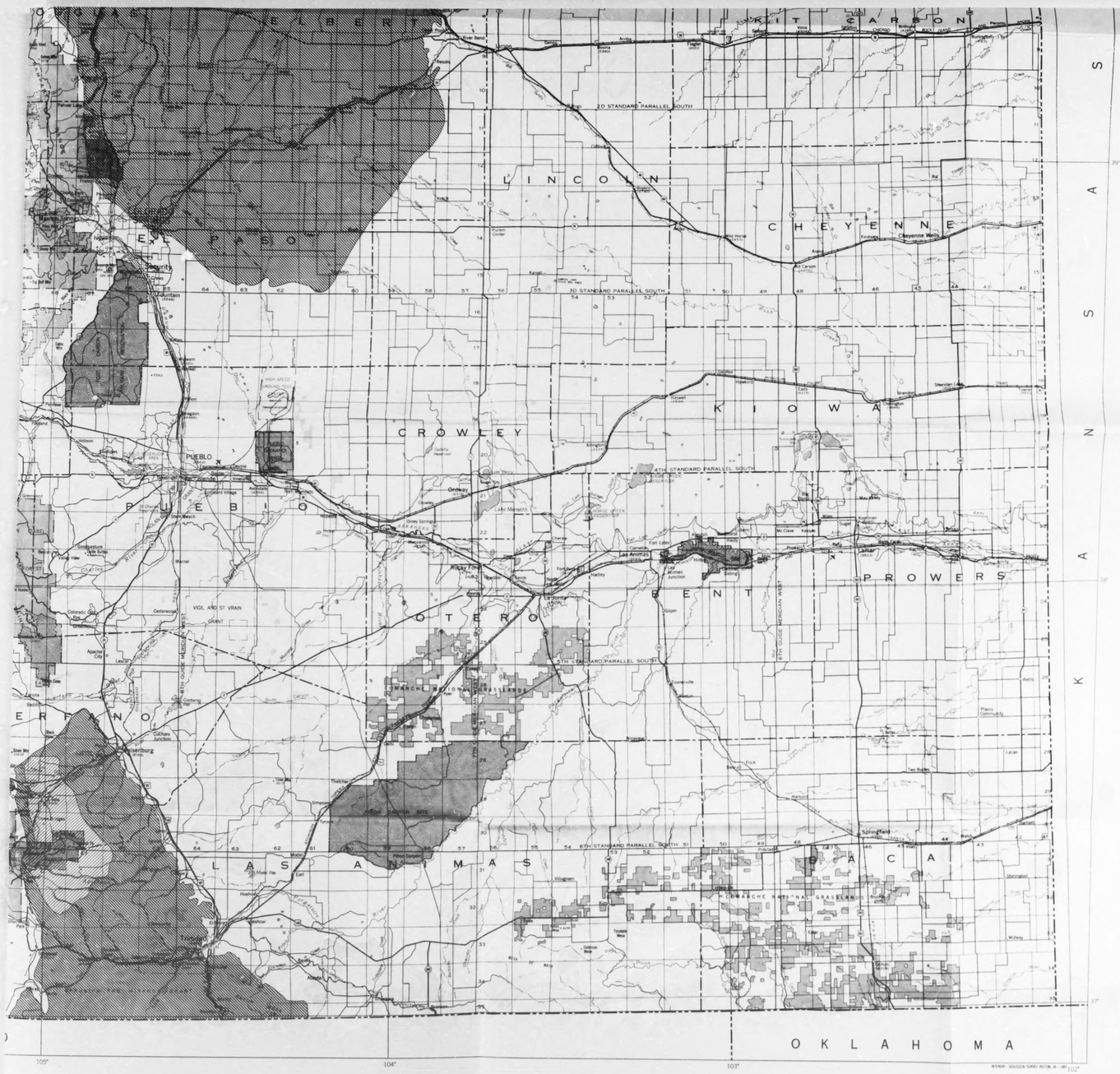
AVAILABILITY OF FEDERAL LAND COMPARED TO AREAS FAVOR

1984



congressional or executive methods, including laws, executive and secretarial orders, and public land orders

AREA UNAVAILABLE OR SEVERELY RESTRICTED (MANAGEMENT)—Includes areas unavailable or severely restricted to mineral exploration and development to such an extent that these activities are greatly discouraged by management practice owing to agency policy, decision, or regulation, or by other discretionary action

MINERAL FAVORABILITY

AREAS UNDERLAIN BY ROCKS THAT ARE KNOWN TO GENERALLY CONTAIN COAL, AT DEPTHS OF LESS THAN 3,000 FT (17, 18, 50)—Specific parts of these areas may be barren or contain coal in uneconomic amounts. Includes known coal deposits, coal of all ranks, and coal in multiple beds

AREAS UNDERLAIN BY ROCKS THAT ARE KNOWN TO GENERALLY CONTAIN COAL, AT DEPTHS GREATER THAN 3,000 FT (17, 18, 50)

AREAS UNFAVORABLE FOR COAL—Includes areas not underlain by rocks that are known to generally contain coal

[1] Underlined numbers in parentheses refer to items in the list of references in the accompanying report

NOTES TO MAP USERS

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SCALE 1:500,000

1 inch equals approximately 8 miles (13 kilometers)
1 centimeter equals approximately 5 kilometers (5 miles)

10 0 10 20 MILES
10 0 10 20 30 KILOMETERS

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ABLE FOR COAL IN COLORADO

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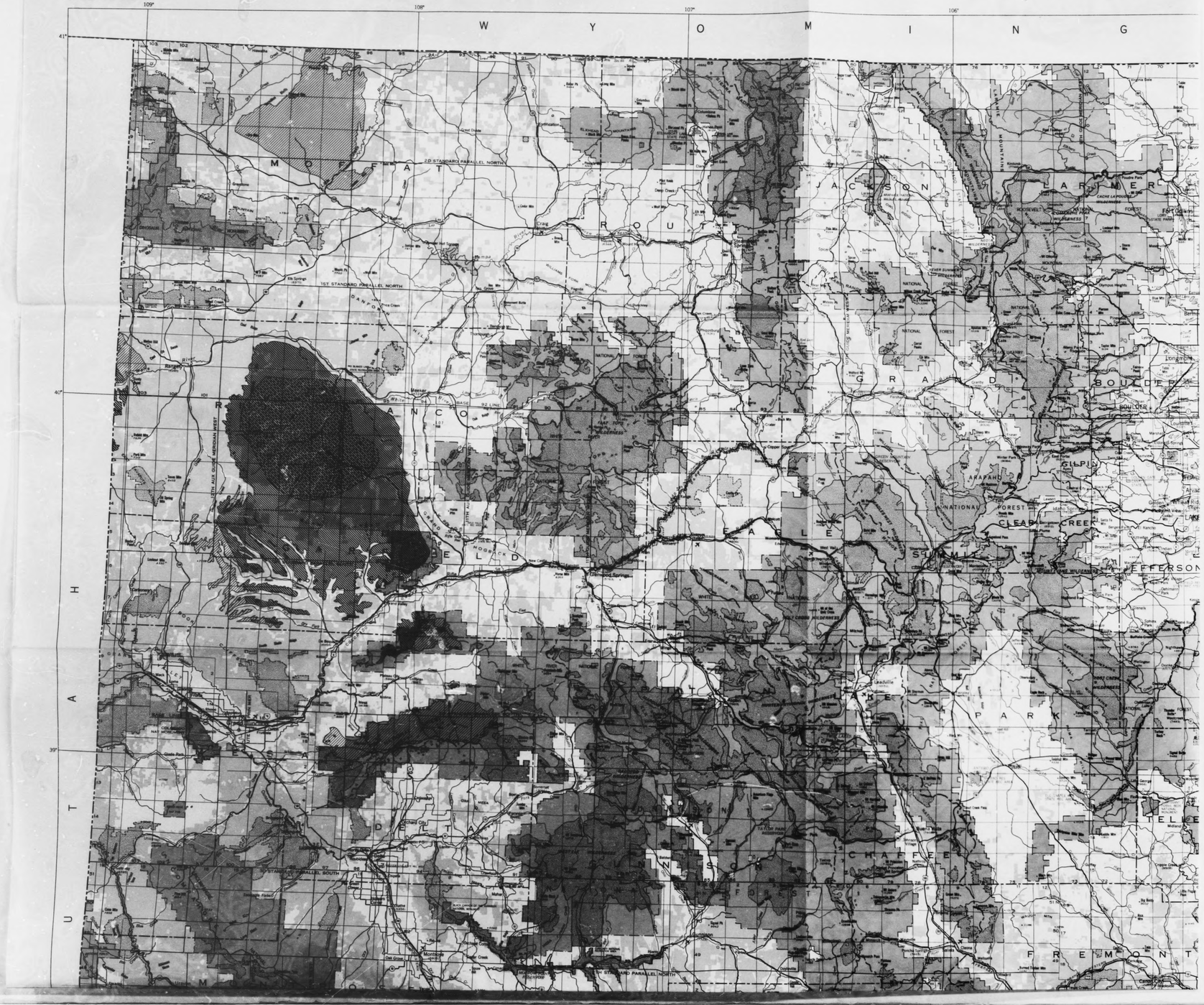

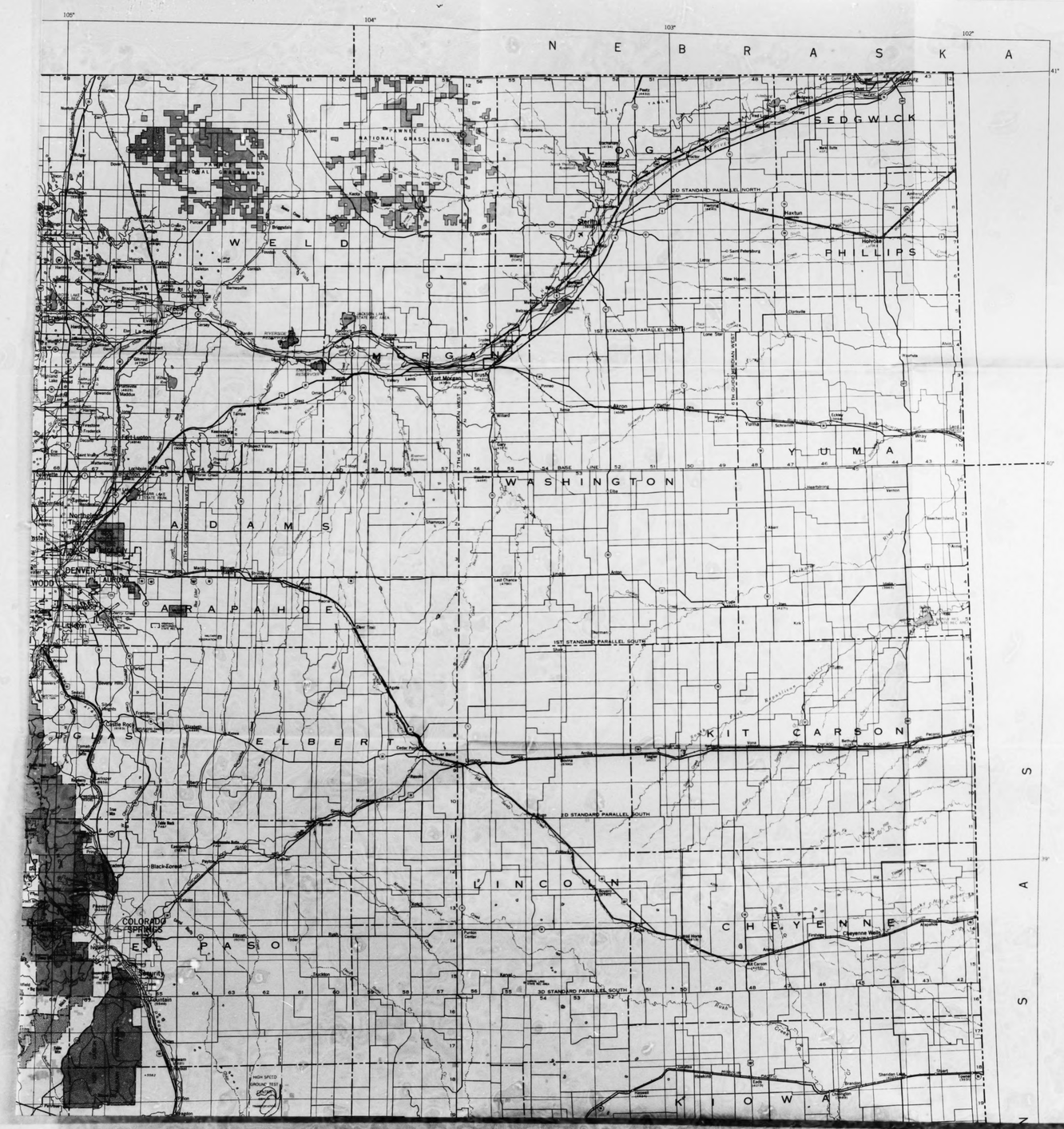

EXPLANATION

FEDERAL LAND (SURFACE) OWNERSHIP

NATIONAL FOREST OR GRASSLAND—Administered by Forest Service

PUBLIC LAND—Administered by Bureau of Land Management

OTHER FEDERAL LAND—Includes land under jurisdiction of Departments of Agriculture, Defense, Energy, and Interior (Bureau of Reclamation, Fish and Wildlife Service, National Park Service), General Services Administration, and Veterans Administration

AVAILABILITY OF FEDERAL LAND

As of July 1, 1984, the Secretary of the Interior had made no decision to offer any additional tracts for oil shale leasing since two tracts were leased in 1974. Thus, all Federal land in Colorado not already under lease is unavailable by management practice.

Aluminum deposits shown on the map are leasable because they contain sodium or potassium minerals. Leasing of sodium (aluminum) deposits in northwestern Colorado, alone, is not likely because these deposits are associated with oil shale. Potassium (aluminum) deposits in southwestern Colorado are presently leasable.

To show what Federal land might be available for oil shale or aluminum leasing at some future date, availability data developed for oil and gas leasing are used on the map. Some of the restricted areas are known to be closed to all leasing, while others are presently restricted only to oil and gas leasing; however, these latter areas could be restricted to leasing for oil shale and aluminum, as well.

Availability data compiled by the Bureau of Mines from various sources, including Bureau of Land Management (BLM) Withdrawal Review Inventory (39),[1] BLM Inventory of De Facto Withdrawals (40), BLM Wilderness Status Map (41), BLM resource management plans (43), BLM oil and gas umbrella environmental assessments (42), and Forest Service forest plans (47), and from personal communications with various Federal agency personnel.

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MINERAL FAVORABILITY

Oil Shale

AREAS UNDERLAIN BY OIL SHALE YIELDING 25 OR MORE GALLONS OF OIL PER TON IN A SEQUENCE OF OIL SHALE BEDS AT LEAST 15 FT THICK (50)

AREAS UNDERLAIN BY OIL SHALE OF LESSER RESOURCE POTENTIAL OR BY UNEVALUATED OIL SHALE (50)

Aluminum

AREAS UNDERLAIN BY ROCKS CONTAINING IDENTIFIED ALUMINUM RESOURCES—Includes areas underlain by dawsonite deposits of 20 million tons or more per square mile that are associated with oil shale in the Piceance Basin (2), and areas of alunite deposits in southern Colorado (14, 17)

Oil Shale and Aluminum

AREAS UNFAVORABLE FOR ALUMINUM OR OIL SHALE—Includes areas not underlain by rocks that are known to contain significant oil shale or aluminum resources. Includes some areas underlain by very low grade oil shale or by aluminum-bearing rocks that are not considered significant

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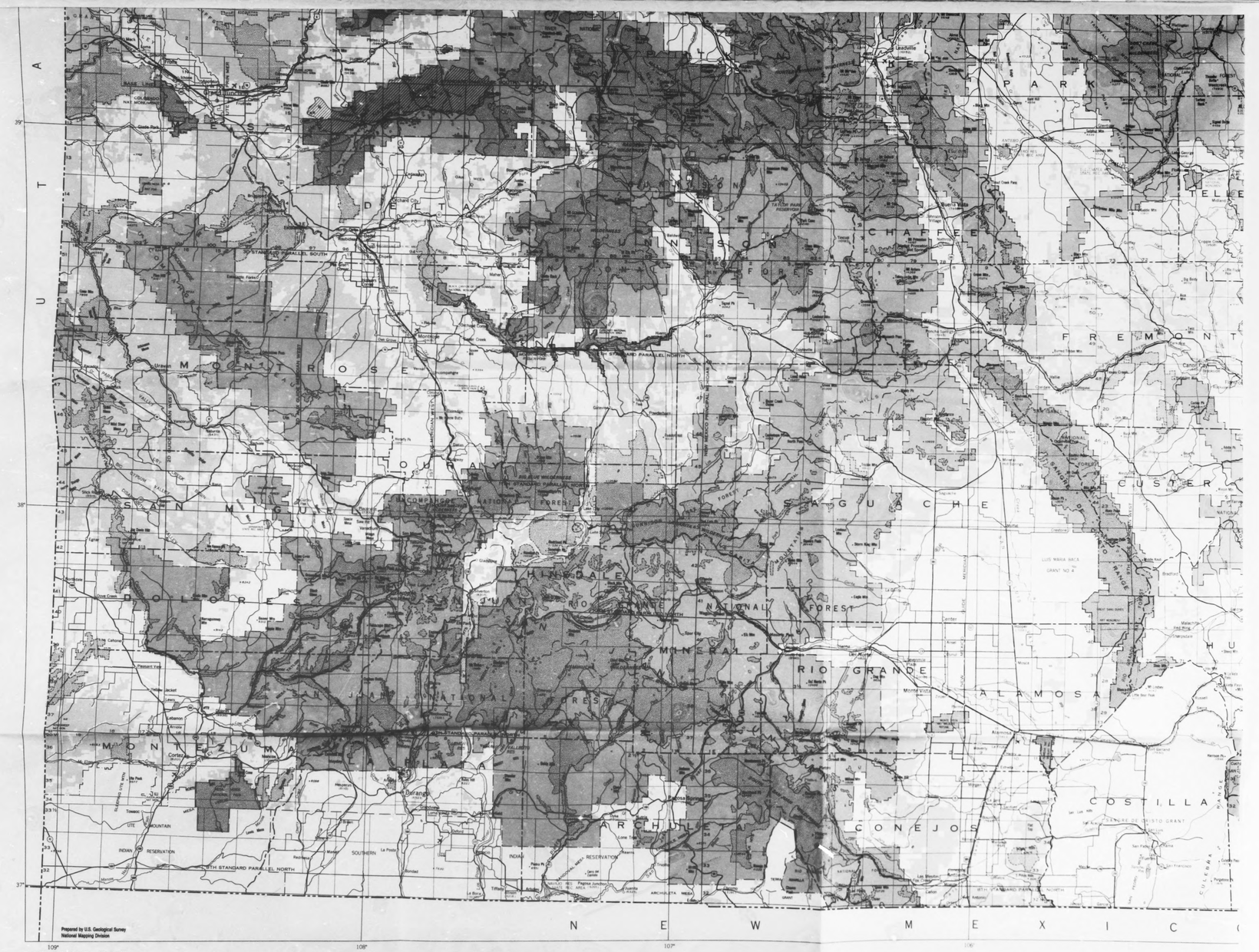
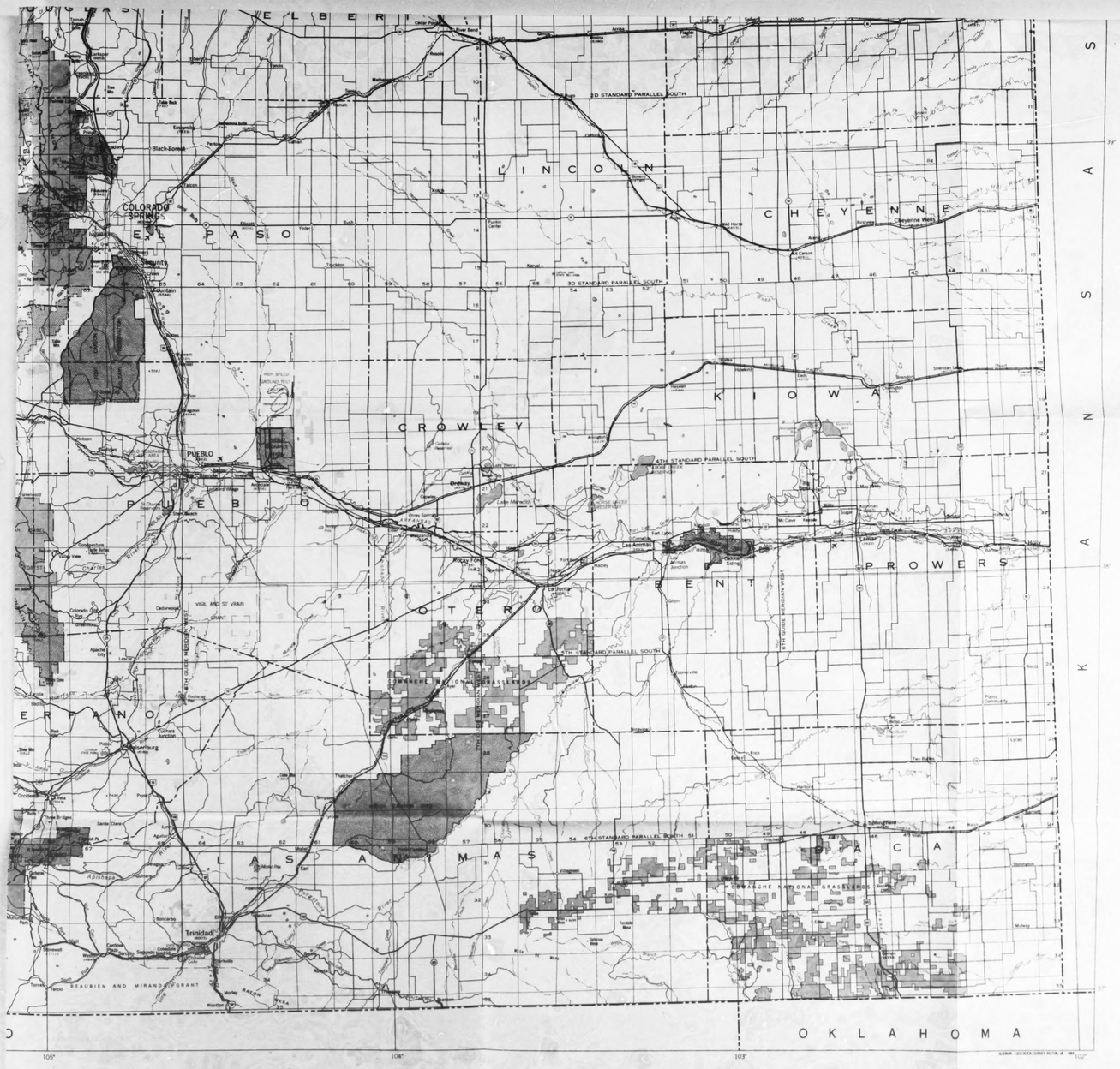

UTAH
COLORADO
NEW MEXICO
39°
38°
37°
109°
108°
107°
106°
SAN JUAN
DELTA
GUNNISON
CHAFFEE
PARK
TELLER
MONTROSE
OURAY
SAN MIGUEL
HINSDALE
DOLORES
MINERAL
RIO GRANDE
ALAMOSA
FREMONT
CUSTER
HUERFANO
LAS ANIMAS
MONTEZUMA
LA PLATA
ARCHULETA
CONEJOS
COSTILLA
SAGUACHE
UTE MOUNTAIN INDIAN RESERVATION
SOUTHERN UTE INDIAN RESERVATION
SOUTH STANDARD PARALLEL NORTH
NATIONAL FOREST
WILDERNESS
Durango
Cortez
Montrose
Telluride
Lake City
Creede
Del Norte
Monte Vista
Alamosa
Salida
Canon City
Pueblo
Trinidad
Walsenburg
Aztec
Farmington
Bloomfield
Chama
Dulce
Ignacio
Bayfield
Pagosa Springs
Ouray
Ridgway
Gunnison
Crested Butte
Buena Vista
Leadville
Fairplay
Hartsel
Westcliffe
Silver Cliff
Rye
Colorado Springs
Manitou Springs
Cripple Creek
Victor
Florence
Cañon City
Penrose
Fountain
Security
Widefield
Fort Carson
Peterson Field
Air Force Academy
Falcon
Calhan
Ramah
Limon
Hugo
Kit Carson
Eads
Lamar
Las Animas
Holly
Springfield
Campo
Granada
Wiley
Sheridan Lake
Ordway
Rocky Ford
La Junta
Swink
Manzanola
Fowler
Las Vegas
Raton
Clayton
Folsom
Capulin
Des Moines
Springer
Maxwell
Cimarron
Eagle Nest
Questa
Taos
Red River
Angel Fire
Chama
Tierra Amarilla
Los Ojos
Cuba
Bloomfield
Aztec
Farmington
Shiprock
Kirtland
Navajo Dam
Bayfield
Ignacio
Pagosa Springs
Durango
Cortez
Dolores
Rico
Telluride
Ouray
Ridgway
Montrose
Olathe
Delta
Paonia
Hotchkiss
Crawford
Gunnison
Crested Butte
Almont
Buena Vista
Salida
Poncha Springs
Leadville
Fairplay
Hartsel
Lake City
Creede
Del Norte
Monte Vista
Alamosa
Center
Saguache
Villa Grove



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OIL SHALE AND ALUMINUM IN COLORADO